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(54) DEVICES FOR DISPENSING MEDICAMENTS

(71) We, ALLEN & HANBURYS LIMITED, a British company, of Three Colts Lane, Bethnal Green, London E2 6LA, do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to inhalation devices by which powdered medicaments can be self-administered to a patient.

It is well known to administer powdered medicament to the lung bronchioles of a patient by means of inhalation devices having mouthpieces which enable the medicament to be inhaled through the mouth of the patient. The medicament is supplied in capsules which are inserted in the device and pierced prior to use after which inhalation through the mouthpiece will cause the powdered medicament to be released from the capsule and passed to the patient. An object of the present invention is to provide an improved such inhalation device which is particularly, but not exclusively, suitable for use in the treatment of asthmatic patients.

Accordingly, the present invention provides such an inhalation device which comprises a chamber arranged to receive a capsule containing a powdered medicament, at least one air inlet aperture leading into the chamber and a nozzle through which air from the chamber can be inhaled, wherein a magazine is slidable and rotatable in the chamber and has a longitudinal capsule loading receptacle arranged so that a capsule inserted therein will have an end portion projecting from the receptacle into the chamber, a knife fixed in the chamber in such a position that rotation of the magazine with respect to the chamber will cause the projecting portion of a capsule located in the receptacle to engage a cutting edge of the knife thereby to sever the projecting portion of the cap-

sule from the remainder of the capsule, and a capsule ejecting member is arranged inside the chamber in a position such that it will enter the capsule loading receptacle when such receptacle has first been registered with the member by appropriate rotation of the magazine with respect to the chamber and then by sliding the magazine with respect to the chamber thereby to eject the remaining part of the capsule from the loading receptacle into the chamber so that the contents of the capsule may be inhaled through the nozzle, and means for preventing the parts of the severed capsule leaving the chamber when the patient inhales through the nozzle.

The knife may be of various forms. For example, it may be a blade with a curved cutting edge having an intermediate fang or point. The knife can be arranged to slice the capsule near one end or centrally of the capsule. Two axially spaced knives may be provided if desired.

The inhalation device is primarily intended for the oral administration of a medicament, in which case the nozzle is a mouthpiece which may be inserted in the mouth of a patient. However, the device may be used for the nasal administration of a medicament in which the nozzle is constructed so that it may be inserted in a nostril of a patient.

In the accompanying drawings, in which like parts are designated by like reference numerals;

Figure 1 is an elevation of an inhalation device according to this invention,

Figure 2 is an elevation of the device illustrated in Figure 1 with a mouthpiece removed,

Figure 3 is a diagrammatic representation of the device in use,

Figure 4 is an exploded perspective view of the device,

Figure 5 is a scrap view illustrating a 90

capsule in a magazine of the device,

Figure 6 is a sectional view on the line Y-Y of Figure 2,

Figure 7 is a sectional view on the line X-X of Figure 3, and

Figure 8 is an exploded perspective view of a modification.

In the embodiment of the invention illustrated in Figures 1-7, an inhalation device comprises a cylindrical body 1 the interior of which defines a capsule-receiving chamber 2. The body 1 has an end wall 3 at one end and is open at the other end. For convenience of description, the end of the body having the end wall 3 is herein considered to be the rear end and the open end is considered to be the front end. A nozzle in the form of a removable mouthpiece 4 is screwed on the front end of the body. A dust cap 4a is removably fitted on the mouthpiece 4. A patient can inhale through this mouthpiece to withdraw powdered medicament from a capsule C which has been divided into a plurality of parts and placed in the chamber 2 as hereinafter to be described. The rear end of the mouthpiece 4 has a grid or guard 5 which prevents the parts of a divided capsule, but not the powdered medicament, being aspirated through the mouthpiece when the patient inhales. The grid or guard 5 is cup-shaped and is secured in the mouthpiece 4 by a retaining ring 6. The parts of a divided capsule tend to rotate on the grid or guard as air is drawn through the chamber 2 and mouthpiece 4 so that if, as is preferred, the grid or guard 5 has a rough surface such rotation assists in vibrating the parts of the capsule and in dispersing the powder.

The wall of the body 1 has a plurality of air inlet slots 7 disposed lengthwise of the body. If desired, these slots 7 are arranged in an area extending only around a major part (say about two thirds of the length) of the periphery of the body. Conveniently, there are not less than two nor more than four slots. These slots 7 communicate with the chamber 2 and are angled with respect to a diametrical chord of the chamber. Thus, when air is inhaled through the mouthpiece 4, it will cause air to pass through the chamber 2 in such a way as violently to agitate parts of a capsule C contained in the chamber. This agitation will cause the powdered medicament still in the capsule parts to be released and allow it to be dispersed in the turbulent airflow.

The resulting powder dispersion will be aspirated through the mouthpiece 4 into the patient.

An operating sleeve 8 is telescopically slidable over the rear end portion of the body 1 and is also rotatable thereon. A magazine 9 (best illustrated in Figure 4) is

arranged inside the body and has an axial shaft 10 with flat surfaces 11 which mate with complementary surfaces in a passage 12 in the sleeve 8 so that the sleeve and magazine are slidable and rotatable together as a unit. The passage 12 is conveniently closed by an end plug 13. The magazine 9 has a capsule-loading passage or receptacle 14 extending lengthwise of the magazine and body, but offset from the axis of the body and magazine. This loading receptacle 14 is open at the front but is closed at the rear by an end wall 14a having a slot 14b. A capsule C containing a powdered medicament to be inhaled can be inserted into the open end of the capsule loading receptacle 14 after the mouthpiece 4 has been removed from the body 1. The length of the receptacle 14 is such that when the capsule has been inserted in the receptacle 14, a front end portion CF (Figure 5) of the capsule will project from the front of the receptacle 14. When the capsule has been inserted in the loading receptacle 14 the mouthpiece 4 is replaced.

A knife 15 is mounted inside the body 1 in a mounting or retaining ring 16. This mounting ring 16 is a sliding fit inside the body 1 and has a key 17 engaged in a keyway 18 forming part of the inside of the body 1. The ring 16, can therefore, slide with respect to the inside of the body 1, but it cannot rotate. The ring 16 is connected with the front end of the magazine in such a way that the magazine can rotate with respect to the ring 16, but the ring and magazine are slidable together.

A capsule-ejector fin 19 is fixed in the body 1 behind the magazine 9 in such an angular position that when the sleeve 8, and therefore the magazine 9, is moved to the open or operative position and the capsule loading receptacle 14 is registered with the fin 19, the fin will enter the loading receptacle 14 thereby to eject the capsule through the open front end of the receptacle 14 into the chamber. The body 1 has a flat projection or peg 20 which fits into an internal groove 21 in the sleeve 8. The ends of the groove 21 form abutments which are engageable by the projection 20 thereby to limit rotation of the sleeve 8 with respect to the body 1.

In operation, a capsule C containing medicament to be inhaled is loaded into the capsule loading receptacle 14 of the magazine 9 and the mouthpiece 4 is then screwed on the body 1. The sleeve 8 is then rotated approximately one half turn. Such rotary movement of the sleeve will also rotate the magazine 9 and the capsule C contained in the loading receptacle 14 of the magazine whereupon the knife 15 and loading receptacle 14 are so positioned with respect to one another that such rotation will en-

gage the projecting portion of the capsule with a cutting edge of the knife 15 thereby to sever the projecting portion of the capsule from the remainder of the capsule. As shown in Figures 1-7, the knife 15 is in the form of a stepped blade with a cutting edge 22 which cuts the capsule. After the capsule has been cut, the sleeve 8 and magazine 9 are then rotated in the opposite direction back to the original position. This will cause the capsule loading receptacle 14, which is open at both ends, to be registered with the capsule ejector fin 19. When the sleeve is correctly positioned, it is slid to its open or operative position and during such movement the fin 19 will enter the capsule loading receptacle 14 of the magazine 9 and in so doing will press against the rear end of the capsule and push it out of the front end of the loading receptacle 14 into the chamber 2. This movement also uncovers the air inlet slots 7 and the patient can then inhale through the mouthpiece 4 so as to inhale the powdered medicament. When the inhalation has been completed, the patient can unscrew the mouthpiece 4 to remove the parts of the spent capsule and other capsule can be inserted in the capsule loading receptacle 14 ready for another inhalation.

Figure 8 illustrates a device with a modified knife 15. In this modification, the knife 15 is in the form of a cup 23 which is retained in position in the body 1 by retaining ring or cup 24. The cup 23 has a cut-away portion in its base to provide cutting edges 25 with and a projecting fang 26. The base of the knife blade has a tab or projection 27 engaged in a slot 28 in the base of the retaining ring or cup 24 to hold the knife against rotation. This arrangement provides a more positive anchoring of the capsule C during a cutting operation than does the arrangement of Figure 1-7 and also makes it possible for the cutting edges of the knife to be less sharp.

The sleeve 8 in both the embodiments of the invention described constitutes a handle by which the device may be held. If desired, the axial shaft 10 may be extended to project from the rear end of the body 1 and terminate in a handle in the form of a knob. The device is then not provided with a sleeve 8.

WHAT WE CLAIM IS:—

1. An inhalation device for administering to a patient medicaments contained in a capsule, the said device comprising a chamber arranged to receive a capsule containing a powdered medicament, at least one air

inlet aperture leading into the chamber and a nozzle through which air from the chamber can be inhaled, wherein a magazine is slidable and rotatable in the chamber and has a longitudinal capsule-loading receptacle arranged so that a capsule inserted therein will have an end portion projecting from the receptacle into the chamber, a knife fixed in the chamber in such a position that rotation of the magazine with respect to the chamber will cause the projecting portion of a capsule located in the receptacle to engage a cutting edge of the knife thereby to sever the projecting portion of the capsule from the remainder of the capsule, and a capsule ejecting member is arranged inside the chamber in a position such that it will enter the capsule loading receptacle when such receptacle has first been registered with the member by appropriate rotation of the magazine with respect to the chamber and then by sliding the magazine with respect to the chamber thereby to eject the remaining part of the capsule from the loading receptacle into the chamber so that the contents of the capsule may be inhaled through the nozzle, and means for preventing the parts of the severed capsule leaving the chamber when the patient inhales through the nozzle.

2. A device as claimed in claim 1, wherein the chamber is defined by the inside of a cylindrical body which is surrounded by a sleeve which is rotatable and slidable on the body, and the magazine is cylindrical and has a shaft which extends out of one end of the body and is connected with the sleeve so as to be rotatable and slidable with the sleeve.

3. A device as claimed in claim 2, wherein the body has a projection engaged in an internal peripheral groove in the sleeve whereby relative rotation between the sleeve and the body is limited.

4. A device as claimed in claim 3, wherein the knife is secured to a mounting ring fixed against rotation inside the body, the knife having a cutting edge positioned so as to be engageable by a projecting portion of a capsule in the loading receptacle in the magazine, the said receptacle extending longitudinally of the magazine but being off-set from the axis thereof.

5. A device as claimed in claim 4, wherein the knife has a cup-shaped blade secured to a mounting ring fixed against rotation inside the body, the base of the said cup-shaped blade having a cut-away portion providing a curved cutting edge with a fang.

6. A device as claimed in either of claims 120

4 or 5, wherein the said receptacle has an end wall which limits movement of a capsule into the receptacle, the end wall having a recess through which the ejector member 5 can pass.

7. A device as claimed in any one of claims 2-6, wherein the nozzle is a mouthpiece removably fitted on one end of the body and the means for preventing capsule 10 parts leaving the chamber is a perforated guard is secured inside the mouthpiece thereby to prevent parts of a capsule in the chamber being withdrawn when air is in-

haled through the mouthpiece.

8. A device as claimed in claim 1, having 15 a handle by which the device may be held.

9. An inhalation device for self-administering to a patient medicaments contained in a capsule substantially as described with reference to the accompanying drawings. 20

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Fig.1.

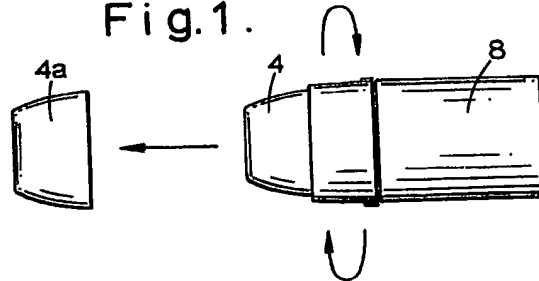


Fig.2.

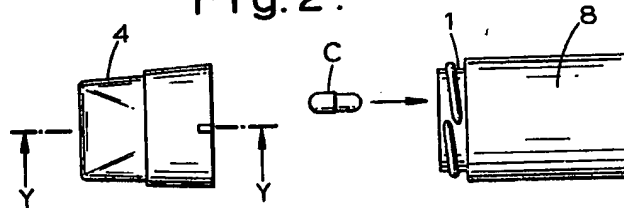
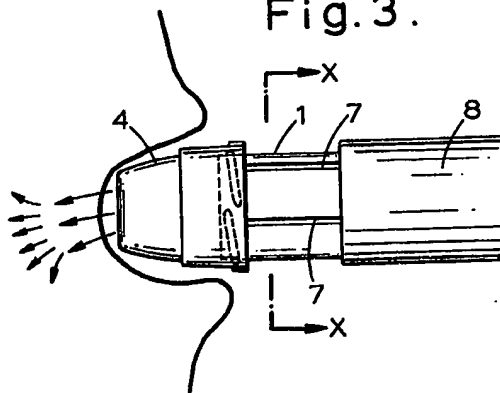


Fig.3.



COMPLETE SPECIFICATION

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Sheet 2**

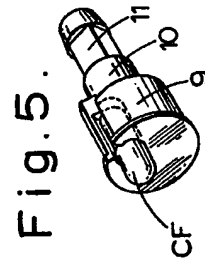


Fig. 6.

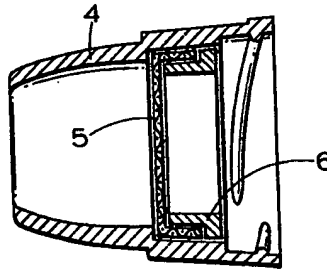
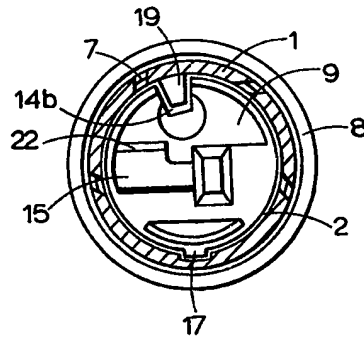


Fig. 7.



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COMPLETE SPECIFICATION

4 SHEETS

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Sheet 4

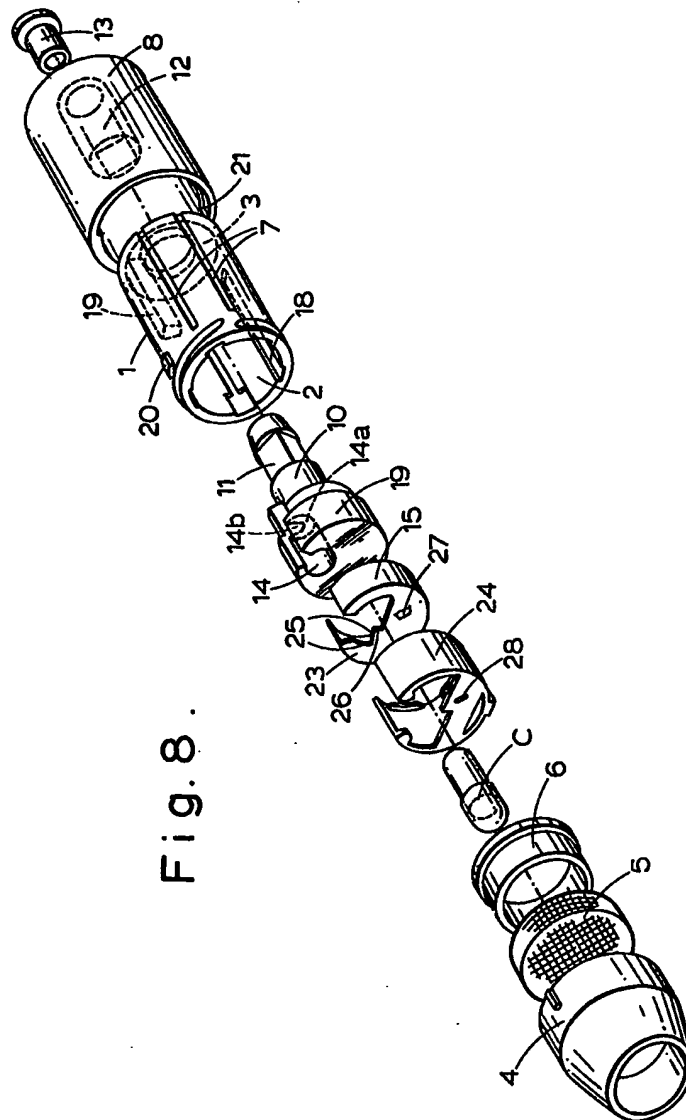


Fig. 8.